

ON THE TREATMENT OF PENETRATING WOUNDS OF THE ABDOMEN.¹

WITH REPORT OF SIXTEEN CASES.

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WE still find some difference of opinion existing among surgeons as to the best method of handling penetrating wounds of the abdomen. It is with the hope that the author's experience during the past two or three years may aid in the solution of this question that this article is written. It is to be understood that these remarks apply entirely to cases in civil life, as the author has had no experience in military practice, and admits the circumstances in the two cases are entirely different. In civil life the wounds are almost always produced by knife-stabs in street or saloon fights, or by bullets from the ordinary pistol or revolver at short range. The cases are usually taken by the ambulance service to the hospital, where they are seen soon after. Having determined that the wound penetrates the abdominal cavity, there are two main questions which immediately present themselves, namely:

1. Has any of the viscera been injured?
2. Is hæmorrhage taking place?

With the exception of hæmaturia pointing to some injury to the urinary tract, and hæmatemesis to injury to the stomach, injuries of the abdominal viscera give rise to no characteristic symptoms whatever. When the wound of the abdominal wall is so great as to permit the partial escape of some of the viscera, or when the intestinal contents or bile are seen issuing from the wound, we have an ocular demonstration of a fact, but these conditions do not properly belong under the head of symptoms.

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With the exception, then, of the conditions mentioned, there is absolutely not a single known symptom or group of symptoms which indicates a penetrating wound of any of the abdominal viscera. The stomach, intestine, liver, pancreas, spleen, etc., may be perforated without giving rise to any symptoms by which the fact may be known. Whenever we find symptoms in a patient with a perforating wound of the abdomen, these symptoms always indicate, not that some viscus has been injured, but *something else*, which something else, however, may or may not be the result of a perforation of the viscera. This may appear to be a distinction without a difference, but such is not the case. There is a very material and practical difference, and the sooner it is recognized by the surgeon, the more lives will be saved in this class of injuries. With the exception of shock in its general sense, which indicates nothing specific, but may be present in an injury of any kind, all of the symptoms which are usually associated with injuries of this kind are due to hæmorrhage or peritonitis. This fact cannot be too strongly emphasized. The symptoms of hæmorrhage may come on immediately and result fatally in a few minutes, or they may be delayed some time, depending on the rapidity with which the blood escapes.

The symptoms of severe hæmorrhage, such as a rapid, small, soft pulse, accelerated sighing respiration, restless body and mind, great thirst, pale pinched features, dilated pupils, dim vision, cold clammy skin, etc., are usually easily recognized; but the fact is not so generally appreciated that bleeding may take place slowly and continue for some time without giving rise to marked symptoms. Even the pulse may be maintained at a rather uniform, slow rate so long as the vasomotor system is able to preserve the arterial tension. When this gives way, serious symptoms appear rather suddenly. An abnormal area of dulness in the abdomen which does not necessarily change its location on change of body position, owing to the fact that much of the blood frequently coagulates, together with a declining red blood count, are the best evidences that a slow hæmorrhage is taking place.

CASE I illustrates the effect of severe rapid hæmorrhage.

November 21, 1903. J. L., aged thirty-six years, was shot from directly in front. Bullet entered in the midline about seven centimetres below the ensiform cartilage, and had a slightly downward direction. He reached the hospital and was seen in thirty minutes from the time he was shot. He presented all the symptoms of a severe internal hæmorrhage, as defined above. The pulse was very rapid and weak, at times almost disappearing. The abdomen was opened as quickly as possible. On drawing up the omentum the cavity was found filled with blood, which welled up rapidly from the upper part. Large hot compresses were rapidly placed and the blood cleared away. On withdrawing the compresses carefully the blood was found to issue from a large wound of the root of the mesentery within a few centimetres of the beginning of the jejunum. The patient succumbed on the table from great loss of blood and shock before the full extent of the injuries could be ascertained.

Autopsy showed perforation of left lobe of liver, of anterior and posterior walls of stomach, and transverse mesocolon; two perforations of the upper end of the root of the mesentery. Bullet entered muscles of back and was found down near left hip.

As illustrating the fact that a hæmorrhage of considerable amount may take place slowly within the abdomen without giving rise to any appreciable general symptoms, the following case may be mentioned:

CASE II.—J. G., aged thirty-six years. A large, strong, healthy man. While working on the corking machine in a beer-bottling establishment, a beer bottle exploded, driving a piece of glass into the abdominal cavity. He was brought to the Alexian Brothers Hospital, November 19, 1902, about noon, and was seen by the author about four hours after the accident. His general condition was excellent. There were practically no symptoms present, and he expressed himself as feeling all right in every way. Pulse was soft, fairly full, and about 75 per minute. There was an irregular wound about four to five centimetres in length in the abdominal wall to the left of the midline and about midway between the umbilicus and the costal arch. An area of dulness could be made out extending from the costal arch

to the left and downward, gradually disappearing. The urine was normal. He was operated on at once by enlarging the original wound. The omentum was found perforated and an artery of considerable size severed just as it was given off by the left gastro-epiploic artery. The lesser peritoneal cavity was filled with blood, and considerable blood was present above the transverse colon and down the outer side of the descending colon. The artery was still bleeding. No injury to any of the viscera was found. The bleeding vessel was secured and the abdomen closed without attempting to remove all the blood present. On the third day the temperature shot up to 104° F., but then became normal, and he recovered without any untoward symptoms. Left the hospital December 17, 1902, but could have gone out ten days sooner had he desired to do so.

The other symptoms which are usually described as indicating perforation of the viscera, such as rigidity of the abdominal muscles, tenderness on pressure, pain, spontaneous or on motion; tympanites, diminution or loss of liver-dulness, rapid small pulse, accelerated costal breathing, vomiting, etc., are not symptoms of perforation, but symptoms of peritonitis. The reason that the mortality following operation in this class of cases was so high, namely, 60 per cent. to 80 per cent. in the past, is that it was customary for the surgeon to wait for symptoms which would indicate that some of the viscera had been injured. This meant to wait until either the patient was in collapse from hæmorrhage, or peritonitis was so far advanced as to be beyond control.

That such practice has not yet entirely disappeared is shown by a recent article by Vincent (*Revue de Chirurgie*, 1901, xxiv, 1), who says, "In bullet wounds (of the abdomen) it is wiser to abstain from early intervention, because the possible lesions are *incertæ sedis*; because the perforations may be too numerous to be all sutured, and they may develop peritoneal adhesions capable of preventing the escape of intestinal liquids.

"In perforating wounds by sharp instruments, it is probably more advantageous to abstain; to await symptoms of

perforation or peritonitis; of a severe hæmorrhage, and to submit the patient to the action of local refrigeration by the use of ice, to repose, to a diet, and to opium."

I believe such advice to be absolutely pernicious and contrary not only to sound judgment, but to the practice of nearly all American surgeons who have had much experience in this class of cases. As there are absolutely no symptoms in the early stage which indicate a perforating wound of the abdominal contents, and as the symptoms when they do arise indicate a severe hæmorrhage or peritonitis, which in the large majority of cases means a fatal issue, there is but one safe and sound course for the surgeon to pursue, and that is to operate on these cases at the earliest possible moment. As it has been shown by Neff that in at least 95 per cent. of these cases damage which needs repair has been inflicted on some of the viscera, it is not only a useless procedure but a great waste of time to attempt to demonstrate the presence of an intestinal perforation by the rectal insufflation of gas or vapor, as recommended by Senn, Sutton, and others, or by the more recent procedure of filling the abdominal cavity with salt solution, withdrawing it later, and submitting to an analysis to determine the presence of contents of the intestinal tract, as recommended by Connell.

In the presence of a penetrating wound of the abdomen, the necessity of opening the cavity at once is so imperative that no time should be lost in useless experimentations. When the abdomen is open, the entire length of the intestinal tract should invariably be examined, as the point of entrance of a bullet or its apparent direction are absolutely unsafe as evidence upon which to speculate that this or that portion of the gut cannot have been injured. While there is a general plan of arrangement of the intestine, this is by no means constant, and one is continually meeting with surprises in these cases. A loop of bowel after being injured may in a very short time move itself to a remote portion of the abdominal cavity, making it appear quite impossible that so many widely separated injuries could have been produced by a bullet travelling in a straight line.

This fact is well illustrated by the following case:

CASE III.—July 26, 1903. J. B., aged thirty-four years. While in a fight with another man he was shot from in front at close range. The bullet entered the left side of the abdomen about five centimetres above and a little posterior to the anterior superior spine of the ilium. The patient reached the Alexian Brothers Hospital about twenty minutes later in good condition. Pulse, 92; temperature, 98° F.; respiration, 22. Thirty minutes after the injury a blood count showed 4,400,000 reds and 8500 whites. Urine negative. Abdomen was soft; no special tenderness. Stomach was washed out, as it was filled with food and beer. Some blood appeared in the washing, which was attributed to the passing of the tube, as the patient had been drinking enough to offer resistance. Operation, within an hour of the time of the shooting; muscle-splitting incision at the site of the bullet hole. The sigmoid flexure was encountered first. In this were found two perforations, one quite low down near the pelvic brim, so low that it was reached and sutured with difficulty. Four perforations were found in the jejunum near the middle portion. These were thought to be all the perforations, but the colon and stomach were examined as a matter of routine. On drawing down the transverse colon, which was well to the upper part of the abdomen, much to our surprise, two perforations were found in it. It seems almost impossible that a bullet entering at the point indicated in this case and travelling approximately from before backward could perforate the sigmoid low down, the transverse colon twice, and the jejunum four times; yet such are the facts, which are explainable by the great mobility of nearly all parts of the intestinal tract. Although this abdomen was opened within an hour of the time of the shooting, intestinal contents were found distributed from the upper to the lower part of the cavity. Thorough irrigation with salt solution was employed and four cigarette drains placed. Death on the fourth day from peritonitis. At the autopsy all the perforations were found well closed and none had been missed.

Another similar example is that of Case IV.

CASE IV.—June 28, 1903. J. McC., aged thirty-six years. Shot from in front with a revolver at short range. Bullet entered

right iliac region about McBurney's point. Patient reached hospital within an hour in very good condition, and was operated on within two hours. Abdomen opened at seat of wound. One very large hole was found in the cæcum with considerable hæmorrhage from a branch of the ileocolic artery. This had spread into the retrocolonic space as well as into the free cavity. Three perforations were found in the jejunum about fifty-four centimetres from the upper end, one bruise of jejunum lower down about two centimetres in diameter, which was turned in; one perforation of mesentery near intestinal border. All perforations closed with silk. Abdomen irrigated with hot salt solution. Four cigarette drains placed. No trouble with abdomen, but on eighth day patient developed pneumonia, with temperature from 102° to 103.5° F. for about ten days. This subsided, and he made a good recovery.

As illustrating the difficulty or at times impossibility of finding perforations of the stomach, the following case is given:

CASE V.—O. B., aged nineteen years, was shot July 19, 1903, while trying to escape from a "hold-up" man. The bullet entered the eighth interspace in posterior axillary line on the left side and took a transverse direction. He reached the hospital about forty minutes later in considerable shock, and complained of great pain in the chest and back. Pulse, 110; respiration, 28. Blood count showed 4,800,000 reds, 9800 whites. Urine negative. It was evident the left pleura and lung had been injured, and from the course of the bullet it seemed certain that it must have perforated the diaphragm and traversed the abdominal cavity. A median cœliotomy was therefore made about one and one-half hours after the shooting. A large hole was found in the diaphragm, through which blood and air passed in and out of the pleura. This was packed with gauze. Two perforations were found in the splenic flexure of the colon, which were closed by suture. It did not seem possible that the stomach could have escaped, but very careful examination failed to reveal any injury to it. It was quite well distended, but no leak could be found. The patient's condition was bad, and, as no further wounds could be discovered, cigarette drains were placed and the operation

terminated. Five hours after the operation the patient was paralytic, and in twelve hours he was dead. Autopsy showed perforation of left pleura and lung with some blood and air in pleural cavity; perforation of diaphragm; two perforations of splenic flexure of colon (closed by suture); two perforations in cardiac end of the stomach near œsophagus, in what may be called the extraperitoneal portion of the stomach. These openings had not permitted any of the contents of the stomach to escape; injury to lower dorsal vertebræ with hæmorrhage into the spinal canal, compressing spinal cord; perforation of right side of diaphragm with hæmorrhage into the right pleural cavity.

CASE VI.—February 15, 1903. L. P., aged thirty years. During a quarrel was stabbed in the abdomen and chest. He was somewhat under the influence of liquor, but otherwise in good condition when he reached the hospital about half an hour later. Was operated on within two hours from the time he was stabbed. One stab wound, about two and one-half centimetres in length, was situated just above the right anterior superior spine of the ilium. A loop of small intestine protruded through this wound. A second wound, about two centimetres long, was situated between the eleventh and twelfth ribs, about seven centimetres to the right of the vertebral spines. This opened the pleural cavity and perforated the diaphragm. The wound was cleaned and packed with gauze. The wound of the abdomen was enlarged, and two cuts, one and one-half centimetres and one-half centimetre respectively in length, were found in the ileum, and one small cut in the cæcum. These were all closed and two cigarette drains placed. Patient made an uninterrupted recovery.

CASE VII.—H. J., aged fifty-two years, was injured November 11, 1902, in a street-car accident. A piece of glass from a broken window produced a somewhat irregular wound about ten centimetres in length, extending obliquely across the upper portion of the right side of the abdomen. The wound penetrated the abdominal cavity, and a loop of the small intestine several centimetres in length, which had also been cut by the glass, protruded from the wound. He was seen within an hour after the accident. The intestine was sutured, thoroughly cleansed, and replaced; two cigarette drains introduced and a part of the external wound closed with suture. The patient recovered without interruption.

CASE VIII was a bullet wound of the liver. T. G., aged twenty-four years, shot, March 2, 1903, while trying to "hold-up" a saloon keeper. The bullet entered about five centimetres to the left of the midline and six to eight centimetres above the umbilicus. When he entered the Passavant Hospital his pulse was 124, fair volume; temperature, 99° F. Had been drinking. Was seen and operated on within two hours of the shooting. Median incision. The track of the bullet was from before backward and from left to right. The bullet entered the left lobe of the liver, passed through the entire breadth of this organ, and escaped from the posterior border on the right side. It penetrated the body wall behind and lay just beneath the skin. He was bleeding quite freely from the point of entrance and exit in the liver, and considerable blood was found in the abdominal cavity. The openings in the liver were packed with gauze. It was rather difficult to reach the posterior wound, but this was done, and the ends of the gauze strips were brought out of the anterior incision. The incision in the abdominal wall was closed, with the exception of space for the drain. Packing removed in about a week. Recovered and left hospital April 1, 1903.

CASE IX.—February 17, 1903. A. B., aged fifteen years, shot himself accidentally with a 22-caliber revolver. After the accident he ran three blocks, then fainted. Was brought to the Alexian Brothers Hospital about 11.30 A.M. Blood count on entrance, reds 4,205,000, white 6000. Three hours later, blood count, reds 4,120,000, whites 12,000. General condition good. Urine negative. Bullet entered slightly to left of midline about four centimetres above the umbilicus. Operation about five hours after he was shot. Median incision. Small amount of blood in peritoneal cavity. Careful search failed to reveal any injury to any of the viscera. The bullet fell from a fold of omentum as this was being straightened out preparatory to closing the incision. The bullet had not injured the omentum in the least. Its force was just sufficient to penetrate the abdominal wall. Wound closed. Uninterrupted recovery.

CASE X.—A. S., aged seventeen years. On August 19, 1903, he was struck in the abdomen just above the pubis by a bullet fired from a revolver. Bullet ricocheted from a stone wall before striking him. Patient in good condition when he reached Alexian Brothers Hospital. No bladder or rectal symptoms. Operation,

median incision, passing through the tract of the bullet. No injury to any of the viscera. Bullet found somewhat flattened on the inner side of the symphysis pubis near its lower border. Wound drained with gauze. Recovery uneventful.

CASE XI.—Mrs. B., aged twenty-five years. Shot herself with a 32-caliber revolver. Bullet entered abdomen to the left of midline about midway between umbilicus and costal arch. She was brought to the Policlinic Hospital within a few minutes of the shooting. She showed distinct symptoms of internal hæmorrhage and the pulse was quite rapid and small. Was operated on about an hour and a half after the accident. Median incision, considerable blood in the abdominal cavity. There were found one perforation of the omentum, which was bleeding; two perforations of the jejunum, and four perforations of the mesentery. These were all closed with silk. Abdominal incision closed. Uneventful recovery. Bullet, which lay just beneath the skin of the back to the right of the spine, was removed later under local anæsthesia. Left hospital at the end of three weeks.

CASE XII.—M. L., aged eighteen years. During a fight was stabbed in the abdomen. Knife entered in the midline just above the umbilicus. Reached the hospital shortly after and was seen and operated on within an hour. Omentum was protruding from the wound. The wound was enlarged, protruding omentum ligated and removed. One good sized wound of small intestine found, which was sutured with silk. Abdomen closed without drainage. Uninterrupted recovery. Left hospital on twenty-first day.

CASE XIII.—Mr. F., aged twenty-six years. Was in the same fight that Case XII was. Entered the Policlinic Hospital and was operated on at the same time. Received several stab wounds. Three wounds in the right posterior side of the chest, through one of which air was whistling in and out with respiration, four stabs in left arm and forearm, one stab in left thigh and one stab six centimetres to the left and two and one-half centimetres above the umbilicus, from which omentum was protruding. This wound was enlarged and the protruding omentum ligated and removed. One perforation was found in the jejunum and a slit cut in the transverse mesocolon. These were closed with silk. Abdomen closed without drainage. Wound of pleura was cleaned and packed with gauze. Other wounds dressed.

Recovered without incident and left hospital on the twenty-first day.

CASE XIV.—I. R., aged twenty-six years. Shot September 30, 1903. Bullet entered abdomen a trifle above and two and one-half centimetres to the left of the umbilicus. Its direction was oblique from left to right. Entered Alexian Brothers Hospital about thirty minutes after the shooting in good condition. Operation, median incision. Two perforations in transverse colon and one in hepatic flexure were found, which were closed by silk suture. A counter-opening was made well back on right side of abdomen, through which was introduced a cigarette drain just above the hepatic flexure and transverse colon. Abdomen closed in front. Considerable thick tenacious yellowish fluid escaped along the drain for three or four weeks. It appeared to be bile-stained, but failed to give the reactions for bile. On November 18 he suddenly, and without permission, escaped from the hospital. He was in excellent condition and had practically recovered, but the small drain opening had not quite closed.

CASE XV.—J. K., aged twenty-five years. Shot, November 14, 1903, with a 38-caliber revolver. Bullet entered abdomen on a line with the umbilicus about ten centimetres to the left and lay directly under the skin in the back about ten centimetres from the spine. Entered Alexian Brothers Hospital in good condition, except that he had been drinking considerable beer. Pulse was 90 and full, and there were no symptoms of shock. He was operated on about three hours after the shooting. Muscle-splitting incision at seat of bullet wound. There were found one perforation in colon near beginning of sigmoid; one severe bruise in descending colon; two very large perforations about two and one-half centimetres apart in upper part of jejunum; two bad bruises of jejunum near perforations. Perforated part of jejunum had moved to upper part of abdominal cavity quite a distance from point of entrance of bullet. Intestinal contents had escaped about adjoining loops. Entire small intestine was washed with hot salt solution as it was drawn up and examined. Perforations were closed and bruises turned in with silk. Four cigarette drains placed, two about loop of jejunum and two about colon. Uninterrupted recovery.

CASE XVI.—The last case to be reported was that of a lad sixteen years of age. He ran across the street to see a fight,

and was stabbed in the abdomen. Knife entered a little above and about four centimetres to the right of the anterior superior spine of the ilium. He was brought to the Alexian Brothers Hospital, where he was seen and operated on within two hours of the accident. General condition good and no symptoms of shock. The wound was enlarged and the intestine examined. One loop of ileum was found to have been transfixed by the knife, almost severing the gut, and an adjoining loop entered, making three wounds altogether. These were closed with silk suture and cigarette drains placed. He made an uninterrupted recovery.

In our sixteen cases of penetrating wounds of the abdomen there were three deaths. Case I died quickly from rapid, profuse internal hæmorrhage before the source of the hæmorrhage could be discovered and controlled. It may therefore be excluded. Case V may also be excluded, as death was due to shock from injury to both lungs and pleuræ and to the spinal cord.

Excluding these two cases, we have fourteen cases remaining with but one death, Case III, with eight perforations involving the sigmoid, small intestine, and transverse colon, with death on the third day from peritonitis. While in Case II no injury to any of the viscera was found, still, operation was imperative on account of hæmorrhage. In Cases IX and X neither injury to the viscera nor excessive hæmorrhage was found.

It may be claimed that these cases would have recovered without operation, and this is undoubtedly true; but who could have foretold before the abdomen was opened? The operation not only did no harm, but was productive of good, as the bullet, which might have given rise to subsequent trouble, was removed in each case.

But excluding these cases, we still have eleven cases with perforations and hæmorrhage in which operation was absolutely indicated with but one death. Instead of the usual mortality rate of 60 per cent. to 70 per cent. following operation, we have over 90 per cent. recoveries.

The reasons for this, according to the author's opinion, are chiefly two:

First. Immediate operation. All cases but one were operated on within three hours or less of the time of the accident.

Second. Drainage when the gastro-intestinal tract has been opened.

Every case in which the gastro-intestinal tract has been perforated must be considered an infected wound. Because rarely a case may recover without operation, in which the intestine has been opened, although the proof of this latter point is almost always wanting, except when a faecal fistula forms, is no reason why the large majority of these cases should be subjected to a so-called conservative treatment, which almost certainly ends in death, in order to save the rare case from what may be thought an unnecessary operation.

The question of drainage in this class of cases was thoroughly discussed at the meeting of the American Surgical Association, 1902 (*Transactions of the American Surgical Association, 1902*), and the consensus of opinion was in favor of drainage.

In conclusion, I wish to emphasize the following points:

1. In penetrating wounds of the abdomen, there are absolutely no known symptoms which indicate injury to any of the viscera, except those noted above in connection with the urinary tract, stomach, and occasionally the lower bowel.

2. Except those relating to general shock, all symptoms following such wounds indicate either internal hæmorrhage or peritonitis.

3. To wait for symptoms of perforation of the intestine means to wait until peritonitis has developed, therefore,

4. Every bullet or stab wound which penetrates the abdominal cavity should be operated on at the earliest possible moment in order to anticipate the advent of peritonitis.

5. No time should be wasted in attempting to demonstrate the presence or absence of intestinal perforation by such means as the rectal insufflation or gases or vapors, or the analysis of recollected intraperitoneally injected air or liquids.

6. It is essential to systematically examine the entire

gastro-intestinal canal in all cases, regardless of the point of entrance of the wounding body.

7. Whenever the alimentary canal has been perforated, suitable drains (the author prefers the so-called cigarette drains) should be placed either through the operative incisions or counter-incisions, as may appear best suited to the individual case.